UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/214,822	01/11/1999	SERGE MULLER	14XZ00014	8165

7590 06/03/2004

JAY L CHASKIN
GENERAL ELECTRIC COMPANY
3135 EASTON TURNPIKE W3C
FAIRFIELD, CT 06431

EXAMINER
DASTOURI, MEHRDAD

ART UNIT	PAPER NUMBER
2623	

DATE MAILED: 06/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.		Applicant(s)
Office Action Summary	09/214,822		MULLER ET AL.
	Examiner		Art Unit
	Mehrdad Dastouri		2623

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 October 2001*.

2a)☒ This action is **FINAL**.   2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
   closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

   4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

   Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

   Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   a)☐ All   b)☐ Some * c)☐ None of:

   1.☐ Certified copies of the priority documents have been received.

   2.☐ Certified copies of the priority documents have been received in Application No. _____.

   3.☐ Copies of the certified copies of the priority documents have been received in this National Stage
      application from the International Bureau (PCT Rule 17.2(a)).

   * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☐ Notice of References Cited (PTO-892)
2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3)☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
   Paper No(s)/Mail Date <u>9</u>.

4)☐ Interview Summary (PTO-413)
   Paper No(s)/Mail Date. _____ .
5)☐ Notice of Informal Patent Application (PTO-152)
6)☐ Other: _____ .

U.S. Patent and Trademark Office
PTOL-326 (Rev. 1-04)   Office Action Summary   Part of Paper No./Mail Date 12

DETAILED ACTION

Response to Amendment

1.   Applicants' amendment and petition for revival of the abandoned application filed

October 26, 2001, has been entered and made of record. The petition for revival has

been granted and the application has been forwarded for examination.

Oath/Declaration

2.   The Declaration filed on October 26, 1999 is acceptable.

Specification

3.   Objection to the specification has been withdrawn in view of Applicants'

amendment.

Rejection of Claims

4.   35 U.S.C. 103(a) rejection of Claims 1-15, 19 and 20 over Nields,

U.S. 5,776,062, has been withdrawn in view of the submitted English translation of the

foreign priority document because Nields filing date is after Applicant's claimed foreign

priority date.

5.   Applicants' argument regarding 35 U.S.C. 112 rejection of Claim 1 is not

persuasive. The specification disclosure that is recited in the claim will not overcome

claim ambiguities.

6.   35 U.S.C. 112 rejection of Claim 18 has been withdrawn in view of Applicants'

amendment.

Response to Arguments

7.   Applicants' arguments regarding 35 U.S.C. 103(a) rejection of Claims 1-19 and

21 in view of combined teachings of Robb et al, Mick et al, Kenet et al, and

Gerstenberger (Prior arts of record) have been fully considered but they are not

persuasive. The comprising language of the claimed invention does not exclude

contour extraction in regions of interest of reference and target images disclosed by

Robb et al. Furthermore, since no specific methodology for correlation processing has

been recited in the claims, the image registration taught by Robb et al meet claim

language limitations. Robb et al also consider a central search point among the search

area as disclosed in Column 6, Lines 64-67, Column 7, Lines 1-11. It is further

submitted that Gerstenberger is the prior art that is relied upon for the specifics of

correlation processing.

Claim Objections

8.   Claims 1-21 are objected to because of the following informalities:

In Claims 1, 7 and 16, steps identifiers (e.g., "a.", "b.", etc. in Claims 1 and 7, and

also "a..", "b..", etc. in Claim 16" should be corrected to "a", "b", ..., "i" correspondingly, to

delete the additional periods. Claims should be started with a capital letter and ended

with a period. No additional periods are allowed in body of claims.

In Line 7 of Claim 16, "of at" should be corrected to "at".

Appropriate correction is required.

Information Disclosure Statement

9.   The information disclosure statement filed October 26, 2001 fails to comply with

37 CFR 1.98(a)(3) because it does not include a concise explanation of the relevance,

as it is presently understood by the individual designated in 37 CFR 1.56(c) most

knowledgeable about the content of the information, of each patent listed that is not in

the English language (Foreign Patent Document FR 91 15308). It has been placed in

the application file, but the information referred to therein has not been considered. It is

further submitted that a copy of Non-Patent Literature (Author Serra) is not included in

the IDS.

Claim Rejections - 35 USC § 112

10.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly
> claiming the subject matter which the applicant regards as his invention.

11.   Claims 1-21 are rejected under 35 U. S. C. 112, second paragraph, as being

indefinite for failing to particularly point out and distinctly claim the subject matter which

applicant regards as the invention.

In Claims 1 and 7, in step c, the phrase "a second region of interest homologous

to the first region of interest and appearing in a second region of interest" is vague and

indefinite. It is not clear whether the second region of interest is selected from a second

stereotaxic image to which the first image region of interest to be matched or not.

Claims should be unambiguous and meet the specification disclosure.

In Claims 1 and 7, in step d, matching process is ambiguous. It is not clear that

"a generated target window of chosen dimensional characteristics and containing the

target region of interest around the selected target pixels" will be matched to which

region.

12.   Claims 1 and 7 recite the limitation "the first region" in Line 8. There is

insufficient antecedent basis for this limitation in the claim.

        Claims 1 and 7 recite the limitation "the target region of interest" in Lines 11 and

15, respectively. There is insufficient antecedent basis for this limitation in the claim.

        Claims 1 and 7 recite the limitation "the second image" in Lines 12 and 12,

respectively. There is insufficient antecedent basis for this limitation in the claim.

        Claim 16 recites the limitation "the target region" in Line 8. There is insufficient

antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

13.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
> the prior art are such that the subject matter as a whole would have been obvious at the time the
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.
> Patentability shall not be negatived by the manner in which the invention was made.

14.   Claims 1, 6, 7 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable

over Robb et al (U.S. 5,568,384) in view of Mick et al (U.S. 5,261,404).

        As per Claim 1 (as best understood by the Examiner) Robb teaches:

        providing a set of digitized stereotaxic images having positions of homologous

regions of interest corresponding to the element of interest and appearing in the set of

stereotaxic images (volume images, Column 3, Lines 55-60);

selecting in a first stereotaxic image a first (base image) target region of interest having a target pixel (Column 3, Line 58);

matching the first region of interest with a second region of interest (object contour) homologous to the first region of interest and appearing in the second region of interest (Column 3, Line 61 through Column 4, Line 10);

matching a generated target window of chosen dimensional characteristics and containing the target region of interest around the selected target pixels (Column 3, Line 55 through Column 4, Line 5);

determining a set of pixels (limited number of points, Column 4, Lines 5-9) in the second image according to a predetermined selection criterion so as to generate a second window having the same dimensional characteristics as the target window around each selected pixel;

Robb's teachings regarding the image registration generally disclose the correlation between images. However, for further emphasis, Mick et al's teachings are further relied upon concerning:

processing a correlation between the gray-scale levels of the pixels in each second window to obtain a correlation for each second window (Column 6, Lines 30-40);

using the correlation values to identify the region of interest homologous to the target region of interest (Column 6, Lines 50-65, Column 8., Lines 6-15) and thereby minimize the risk of matching error between the homologous regions of interest. The last phrase of this sentence ("minimize the risk of matching error between the

homologous regions of interest") is a well-known feature of pattern recognition and typically strived for by all matching systems.

It would have been obvious to one of ordinary skill in the art to utilize the teachings of Mick to provide the image processing techniques using correlation to identify a target region in a first and second image to matched by Robb to allow a physician the opportunity to traverse the anatomy prior to penetrating it with instruments to establish the optimum route through the anatomy.

As per Claim 7, it recites generally the same limitations as Claim 1 above and analogous remarks apply. Claim 7 is a broader version of Claim 1 and therefore rejectable for the same reasons.

As per Claims 6 and 15, which recite the matching includes a prior filtering of the stereotaxic images (OFFICIAL NOTICE). First, it would have been obvious to one of ordinary skill in the art to perform some initial filtering to remove any signal distortions caused by patient movement or noise introduced by system sensors. Second., the applicant admits this is wellknown citing an article from 1988 on page 17, Lines 12-17 of his specification.

15.   Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Robb and Mick as applied to Claim 1 above, and further in view of Gerstenberger, (U.S. 5,220,441).

As per Claim 2, Mick does not teach the specifics of his correlation method. However, Gerstenberger does teach:

wherein the correlation values includes the selection of a certain number

(tiepoints, Column 2, Lines 35-50) of correlation maxima or minima, the homologous

region of interest being selected from those for which the associated correlation value is

one of the correlation maxima or minimum (Column2, Lines 50-56).

It would have been obvious to one of ordinary skill in the art to utilize the

correlation algorithms as taught by Gerstenberger in correlating the stereotaxic images

of Robb and Mick to rapidly determine the degree of offset between two images thereby

overcoming resolution and precision limitations.

As per Claim 3, Gerstenberger teaches:

wherein the analysis of the correlation values obtained includes a determination

of the dynamic range of the maxima or minima selected, and the comparison of the

dynamic values obtained with a threshold (Column 3, Lines 3-8).

16.   Claim 4 is rejected under 35 U. S. C. 103 (a) as being unpatentable over Robb

and Mick as applied to Claim 1 above, and further in view of Russ, The Image

Processing Handbook, 2nd Edition, CRC Press, 1994.

As per claim 4, Robb and Mick do not specifically teach:

the correlation processing includes a normalized correlation processing.

However, Russ teaches that normalized correlation is a basic form of correlation utilized

in image processing (Page 342).

It would have been obvious to one of ordinary skill in the art to utilize the

well-known features as taught by Russ in the correlation of images as taught by Robb

and Mick in order to prevent erroneous results from spurious correlation values.

17.   Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Robb and

Mick as applied to claim 1 above, and further in view of Pratt, Digital Image Processing.

Second Edition, Wiley& Sons, 1991.

As per Claim 5, Robb and Mick do not specifically teach using normalized

difference processing. However, Pratt teaches:

wherein the correlation processing includes a normalized difference processing

(p. 669).

It would have been utilize the absolute difference error to as taught by Pratt in the

correlation system of Robb and Mick in order to determine the proper misregistration

offset which is normalized to take into account the different imaging systems, patient

motion, etc. that may effect the alignment of the stereotaxic images.

18.   Claims 8-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Robb and Mick as applied to claims 1 and 7 above, and further in view of Kenet et al.,

(Kenet), U.S. 5,836,872.

As per Claim 8, Robb et al and Mick et al do not explicitly disclose that the

predetermined characteristics comprise shape contrast, or gradient characteristics.

However, Kenet does teach such a limitation (Column 14, Line39).

It would have been obvious to one, of ordinary skill in the art to utilize the body

imaging and classification of body surface and subsurface features techniques as

taught by Kenet in the imaging system of Robb and Mick to improve the accuracy of

quantification and classification of anatomical and physiological features of the human

retina (luring three-dimensional imaging.

As per Claim 9, Kenet teaches:

wherein the comparison processing includes a distance minimization processing between the two sets of numerical values (Column 14, Lines 52-61).

As per Claim 10, Kenet teaches:

wherein the comparison processing includes a distance minimization processing between the two sets of numerical values (Column 14, Lines 52-61).

As per Claims 11 and 12, which depend upon claims 1 and 7 respectively, Kenet teaches:

wherein an epipolar zone containing at least the epipolar segment relating to the target pixel is determined in the second stereotaxic image and the pixels in the epipolar zone contain the selected pixels (Column 14, Lines 47-75).

As per Claims 13 and 14, which depend upon claims 1 and 7 respectively, Kenet teaches: wherein the selected pixels are chosen from the pixels in the second image which have a gray-scale level maxima or minima whose dynamic range is greater than a predetermined threshold (Column 14, Lines 40-43).

19.   Claims 16-19, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Robb.

As per Claim 16, Robb teaches:

providing a set of digitized stereotaxic (volume images, Column 3, Lines 55-60) images having positions of homologous regions of interest corresponding to the element of interest and appearing in the set of stereotaxic images (Column 1, Lines 30-31, Column 2, Lines 17-23);

selecting in a first stereotaxic image of a first target region of interest (base image, Column 3, Line 58);

selecting a second stereotaxic image on the basis of the a first automatic matching of at least a second region of interest (match image, Column 3, Line 59., and Column 4, Lines 15-60);

determining the spatial position of a candidate pixel of a candidate element of interest corresponding to the two regions of interest (Column 3, Line 60 through Column 4, Line 9);

determining the position, in a third stereotaxic image of a projected pixel corresponding to the projection into the third stereotaxic image of the candidate pixel. Robb does not specifically teach such a feature, but he does provide suggestion that his system is capable of performing such a function. In Column 1, Lines 29-31, Robb states that one or more images are transformed to bring them into spatial registration with another. This statements indicates that Robb's method is a sequential method operating on two image surfaces at a time until all of the image surfaces desired to be registered are matched. Also in Column 2 , Lines 49-55, Robb states that the geometric transformation accommodates images of different position, orientation, and size, thereby not limiting himself to only two image surfaces. Further in line 54 of Column2, Robb teaches that his system will adjust the image surfaces to the best fit that minimizes the cost function.

If the process of Robb were sequential then the following step would also be taught as the first automatic matching. Robb teaches providing a second automatic

matching between the target region of interest and a vicinity of the projected pixel (Column 3, Line 59, and Column 4, Lines 15-60). defining a projected region of interest so as to minimize the risk of matching errors between the homologous regions of interest (cot. 4, Lines 5-10).

As per Claim 17, Robb teaches: wherein the selecting in the second stereotaxic image is on the basis of the first automatic matching a set of second regions which may be homologous to the target region;

determining the spatial position of each candidate pixel corresponding to each pair of regions of interest (match surface points, Column 4, Line 57) which is formed by the target region and one of the second regions;

determining the spatial position in the third image of each corresponding projected pixel; and performing the second automatic matching between the target region and vicinity of each projected pixel (Column 4, Line 16 through Column 5, Line 45).

As asserted above in the rejection of Claim 16, the system of Robb would use two images and then integrate the solution of the first matching into the determination of an optimal minimized cost function utilizing the next image to be registered.

As per Claim 18, Rob teaches:

wherein the set of second regions obtained is ordered in the decreasing order of their probability of being in the region homologous to the target region (Column 6, Lines 53-60). One of ordinary skill in the art would have been able to determine a match probability from the resulting local minimum.

wherein the set of projected regions obtained is ordered in the decreasing order

(This is a design choice.) of their probability of being the region homologous to the

target region to form a list of correlated values in decreasing order (Column 6, Lines

60-63); and

wherein the region homologous to the target region is selected as being the one

based upon such ranking (Column 6, Line 62).

As per Claim 19, Robb does not explicitly teach a first automatic matching is a

correlation processing matching.

Automatic correlation matching is a well known image processing methodology

for matching reference and target images (Official Notice).

It would have been obvious to use the image contour features of Robb in

conjunction with the automatic correlation to provide a system using spatially correlated

information that enhances medical diagnosis of a given location of interest in the body.

As per Claim 21, Robb teaches:

wherein the second automatic matching includes a comparison matching

between the target region of interest and each projected region of interest (Column 4,

Lines 16-20).

21. Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable

over Robb as applied to claim 16 above, and further in view of Nields.

Contact Information

20.   Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Mehrdad Dastouri whose telephone number is (703)

305-2438. The examiner can normally be reached on Monday to Friday from 8:00 a.m. to 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703) 308-6604. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MEHRDAD DASTOURI
PRIMARY EXAMINER

Mehrdad Dastouri
Primary Examiner
Art Unit 2623
May 31, 2004